US009480190B2

(12) **United States Patent**
Seo

(10) **Patent No.: US 9,480,190 B2**
(45) **Date of Patent: Oct. 25, 2016**

(54) **FLAT PANEL DISPLAY**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/041,624**

(22) Filed: **Feb. 11, 2016**

(65) **Prior Publication Data**

US 2016/0165763 A1 Jun. 9, 2016

Related U.S. Application Data

(63) Continuation of application No. 13/757,890, filed on Feb. 4, 2013, now Pat. No. 9,265,182.

(30) **Foreign Application Priority Data**

Oct. 30, 2012 (KR) 10-2012-0121376

(51) **Int. Cl.**
H05K 7/20 (2006.01)

(52) **U.S. Cl.**
CPC ***H05K 7/20963*** (2013.01)

(58) **Field of Classification Search**
CPC H05K 7/20; H05K 7/20963; G09G 3/36; G09F 9/00; G09F 1/1345
USPC 361/688–723; 165/80.1–80.5, 165/104.11–104.34
See application file for complete search history.

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(57) **ABSTRACT**

A flat panel display (FPD) including a display panel for displaying an image; a film substrate electrically connected to the display panel, the film substrate including driving circuits; a printed circuit board (PCB) electrically connected to the film substrate, the printed circuit board providing a signal for displaying the image; and a heat radiating unit attached to one surface of the film substrate, the heat radiating unit contacting at least one of the display panel and the PCB.

20 Claims, 2 Drawing Sheets

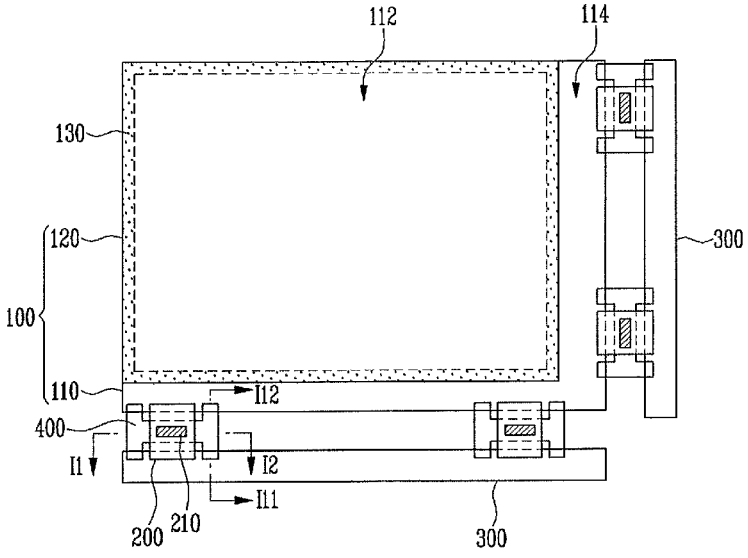

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FIG .1

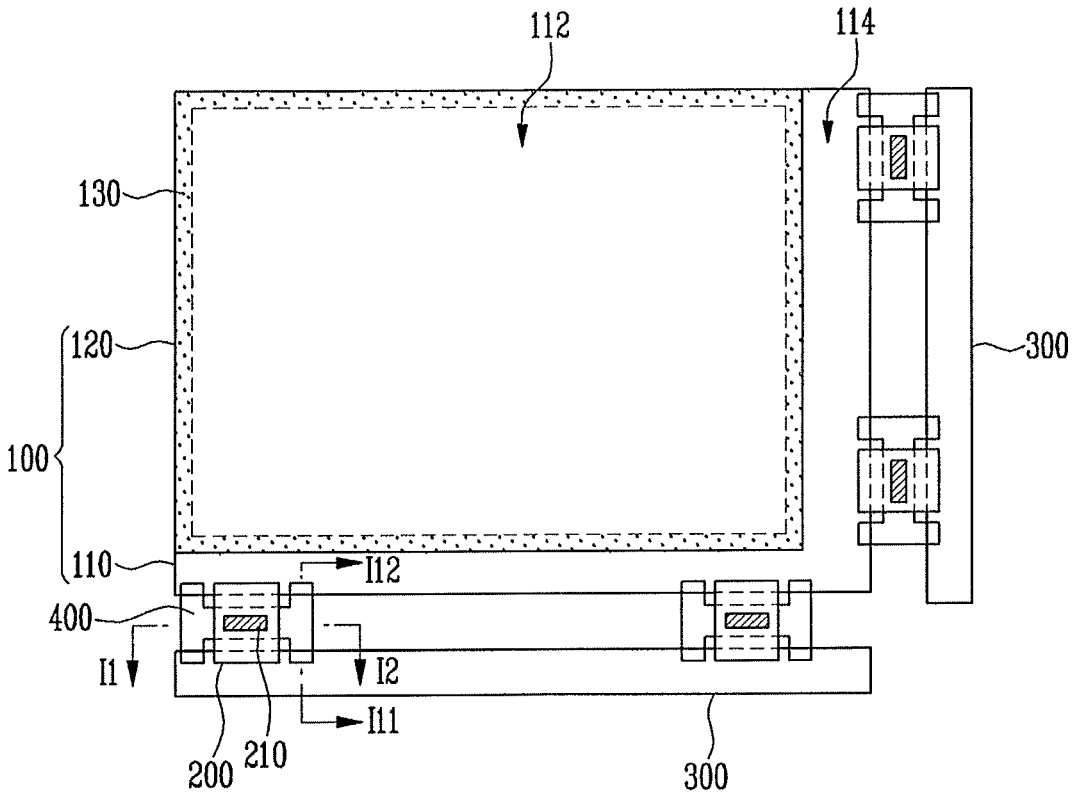

112
114
130
120
100
300
110
I12
400
I1
I2
I11
200
210
300

FIG .2

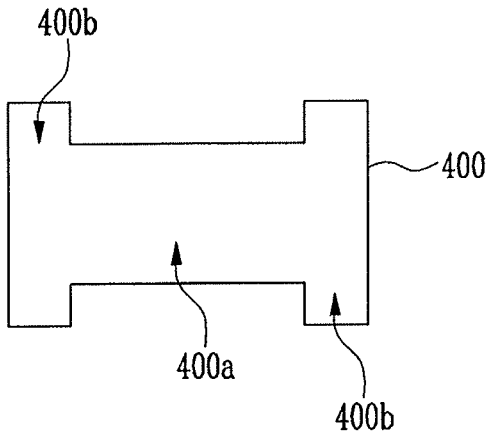

400b
400
400a
400b

FIG .3

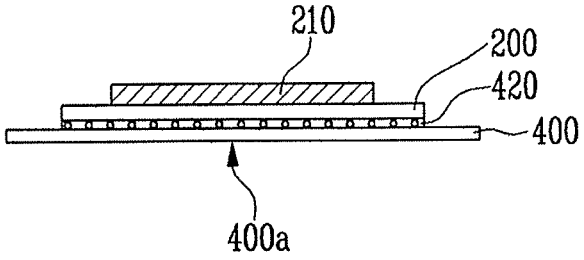


FIG .4

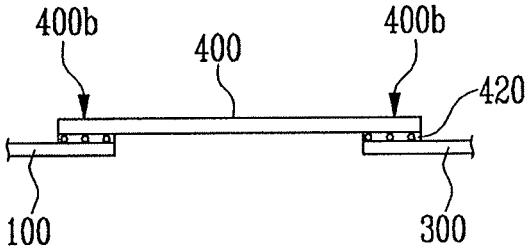


FIG .5

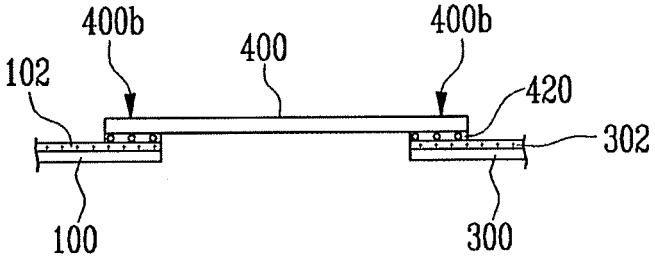
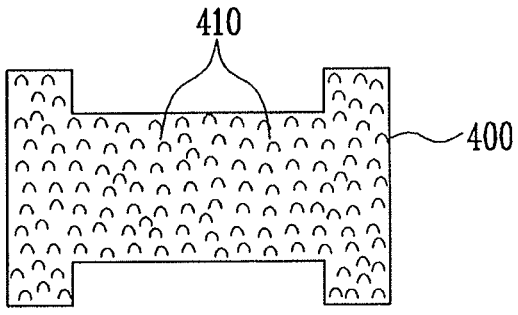


FIG .6



FLAT PANEL DISPLAY

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a continuation application based on pending application Ser. No. 13/757,890, filed Feb. 4, 2013, the entire contents of which is hereby incorporated by reference.

This application claims priority under 35 U.S.C. §119 to Korean Patent Application No. 10-2012-0121376, filed on Oct. 30, 2012, in the Korean Intellectual Property Office, the entire content of which is incorporated herein by reference.

BACKGROUND

1. Field

Embodiments relate to a flat panel display (FPD).

2. Description of the Related Art

A flat panel display (FPD), e.g., a liquid crystal display (LCD) and an organic light emitting display (OLED), may include a display panel (for displaying an image) and driving circuits (for providing signals to the display panel) in order to display the image.

In the display panel, a plurality of pixels may be connected between a plurality of scan lines and data lines, e.g., in a matrix. The driving circuits may include scan driving circuits (for driving the plurality of scan lines) and data driving circuits (for driving the plurality of data lines). Scan signals may be sequentially supplied from the scan driving circuits to the plurality of scan lines so that pixels are selected, and data signals may be supplied from the data driving circuits to the data lines connected to the selected pixels so that a predetermined image is displayed.

As the resolution of the FPD increases, a number of scan lines and data lines increases, so that the size of the driving circuits and the number of driving circuits increase. The increase in the size of the driving circuits means an increase in channels. The power consumption of the driving circuits may increase as the channels increase. Thus, heat emission may increase. In the case of the display panel that displays a high resolution image or a three-dimensional image, the driving circuits should operate at high speed. Thus, a problem may be generated by heat emission.

SUMMARY

Accordingly, the embodiments provide a flat panel display (FPD) capable of effectively radiating heat generated by driving circuits.

In order to achieve the foregoing and/or other aspects of the embodiments, there is provided a flat panel display (FPD), including a display panel for displaying an image, film substrates electrically connected to the display panel and including driving circuits, printed circuit boards (PCB) electrically connected to the film substrates to provide a signal for displaying the image, and heat radiating units attached to one surface of each of the film substrates and contacting at least one of the display panel and the PCBs.

Each of the heat radiating units may include a first contacting unit attached to one surface of the film substrate and at least one second contacting unit that protrudes from an edge of the first contacting unit to the outside and that contacts at least one of the display panel and the PCB.

The heat radiating units may be formed of a thin film-shaped thermally conductive material and may be attached to one surface of each of the film substrate by an adhesive including heat radiating paste.

Protrusions may be provided on at least one surface of the heat radiating unit. Metal pads may be provided in the display panel and the PCBs that the heat radiating units contact.

According to the embodiments, heat generated by the driving circuits and heat generated by input terminals, output terminals, and pads may be rapidly radiated to the outside by the heat radiating units and may be delivered to the display panel and the PCBs through the heat radiating units. Thus, it is possible to prevent the driving circuits from being defective due to accumulation of heat.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, together with the specification, illustrate exemplary embodiments, and, together with the description, serve to explain the principles of the embodiments.

FIG. **1** illustrates a schematic plan view of a flat panel display (FPD) according to an embodiment;

FIG. **2** illustrates a plan view of an embodiment of the heat radiating unit of FIG. **1**;

FIG. **3** illustrates a sectional view taken along the line I1-I2 of FIG. **1**;

FIGS. **4** and **5** illustrate sectional views taken along the line I11-I12 of FIG. **1**; and

FIG. **6** illustrates a plan view illustrating another embodiment of the heat radiating unit of FIG. **1**.

DETAILED DESCRIPTION

The embodiments now will be described more fully with reference to the accompanying drawings. The embodiments may, however, be embodied in many different forms and should not be construed as being limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the concept of the embodiments to those skilled in the art.

FIG. **1** illustrates a schematic plan view illustrating a flat panel display (FPD) according to an embodiment.

Referring to FIG. **1**, the FPD may include a display panel **100** (for displaying an image), a film substrate **200** electrically connected to the display panel **100**, a printed circuit board (PCB) **300** electrically connected to the film substrate **200**, and a heat radiating unit **400** attached to a bottom of the film substrate **200** to contact at least one of the display panel **100** and the PCB **300**.

The display panel **100** may include a first substrate **110**, a second substrate **120**, and a pixel array between the first substrate **110** and the second substrate **120**.

The first substrate **110** and the second substrate **120** may be formed of, e.g., a transparent material such as glass and quartz or an opaque material such as metal. The first substrate **110** may include a display area **112** and a non-display area **114** around the display area **112**. The second substrate **120** may be on the first substrate **110** including the display area **112** and a part of the non-display area **114**. A sealing material **130** may be formed between the first substrate **110** and the second substrate **120** of the non-display area **114** to surround the display area **112**. The pixel array provided between the first substrate **110** and the second substrate **120** of the display area **112** may be sealed up by the sealing material **130**.

The pixel array may include a plurality of pixels connected between a plurality of scan lines and a plurality of data lines, e.g., in a matrix, and may include liquid crystal

cells or organic light emitting diodes (OLED) and may further include thin film transistors (TFT) and capacitors for driving the pixels.

The film substrate **200** may include a driving circuit **210**. The driving circuit **210** (in the form of integrated circuit (IC) chips) may be mounted on the film substrate **200**. Input and output terminals of the driving circuit **210** may be electrically connected to wiring lines (not shown) on the film substrate **200**. The film substrate **200** may be in the form of, e.g., a chip on film (COF). The driving circuit **210** may be formed of a scan driving circuit (for supplying scan signals to the scan lines) or a data driving circuit (for supplying data signals to the data lines).

The PCB **300** may include ICs and elements for receiving an image signal from an outside of the flat panel display and for generating a signal for driving the display panel **100** and various control signals. The PCB **300** may be connected to the film substrate **200** including the scan driving circuits and the film substrate **200** including the data driving circuits.

For example, a plurality of input pads may be formed on one side of the display panel **100** to be connected to the scan lines through the wiring lines, and a plurality of film substrates **200** (including the scan driving circuits) may be electrically connected to the plurality of input pads. In addition, the plurality of input pads may be formed on another side of the display panel **100** to be connected to the data lines through wiring lines, and a plurality of film substrates **200** (including the data driving circuits) may be electrically connected to the plurality of input pads.

The output terminals of the PCB **300** may be electrically connected to the input terminals of the film substrate **200**, and the output terminals of the film substrate **200** may be electrically connected to the input pads of the display panel **100**. The output terminals and the input terminals and/or the output terminals and the input pads may be arranged to overlap each other and may be compressed with an anisotropic conductive film interposed to be electrically connected to each other.

The heat radiating unit **400** (in the form of a thin film or a tape made of a thermally conductive material) may be formed of one or more alloys including a metal selected from the group of Al, Cu, and W.

Referring to FIG. **2**, the heat radiating unit **400** may include a first contacting unit **400***a* (having a same size as or being larger than the film substrate **200**) and/or at least one second contacting unit **400***b* that protrudes from an edge of the first contacting unit **400***a* to an outside, e.g., away from the first contacting unit **400***a*. The at least one second contacting unit **400***b* may be formed on one side of the first contacting unit **400***a* at uniform intervals. In an implementation, the at least one second contacting unit **400***b* may be formed on both sides of one side one by one. The heat radiating unit **400** may be in the form of, e.g., "H" or "I".

Referring to FIG. **3**, the first contacting unit **400***a* of the heat radiating unit **400** may be attached to a bottom of the film substrate **200** by an adhesive **420** that includes a heat radiating paste.

In an implementation, referring to FIG. **4**, the second contacting units **400***b* of the heat radiating unit **400** may be adhered to the display panel **100** and the PCB **300** by the adhesive **420** including the heat radiating paste.

Referring to FIG. **5**, metal pads **102** and **302** may be formed on regions of the display panel **100** and the PCB **300** that contact the second contacting units **400***b*. The metal pads **102** and **302** may be formed of metal having high thermal conductivity. In an implementation, the metal pads **102** and **302** may be formed of an electrode or metal wiring line material, e.g., Al, Cu, and W in a process of manufacturing the display panel **100** and/or the PCBs **300**. The second contacting units **400***b* may contact the metal pads **102** and **302** to expedite or facilitate heat delivery and radiation. Therefore, the metal pads **102** and **302** may be formed to have an area as large as possible. In order to secure a large area, the metal pads **102** and **103** may be connected to, e.g., a ground wiring line or a common wiring line.

Referring to FIG. **6**, at least one surface of the heat radiating unit **400** may be concavo-convex. For example, protrusions **410** may be formed on one surface or both surfaces of the heat radiating unit **400** to increase a surface area of the heat radiating unit **400** and to facilitate radiation of heat. The protrusions **410** may be formed by, e.g., etching the surface of the heat radiating unit **400** or by depositing another material on the surface of the heat radiating unit **400**.

As illustrated in FIG. **1**, the heat radiating units **400** may contact the display panel **100** and the PCBs **300**. However, in an implementation, the heat radiating units **400** may contact only the display panel **100** or the PCBs **300** as desired.

In the FPD having the above structure, heat generated by the driving circuits **210** of the film substrates **200** may be rapidly radiated to the outside through the surfaces of the heat radiating units **400** and may be delivered to the display panel **100** and/or the PCB **300** through the heat radiating units **400**. Thus, it is possible to effectively reduce and/or prevent the driving circuits from being damaged due to accumulation of heat.

When the heat radiating unit **400** contacts only the film substrate **200**, heat may be radiated to the outside only in accordance with an area of the heat radiating units **400**. When an amount of heat emission is larger than the amount of heat radiation, accumulation of heat may be inevitable. However, the heat radiating unit **400** may contact the display panel **100** and the PCB **300**, so that heat may be radiated to the outside while being delivered and may be radiated to the outside through the display panel **100** and the PCB **300**. Thus, heat radiation effect may be excellent.

For example, high temperature heat may be generated by the input terminals, the output terminals, and the pads to which a power voltage is delivered or supplied. According to the embodiments, the heat radiating unit **400** may contact parts adjacent to the input terminals, the output terminals, and the pads. Thus, problems associated with accumulation of heat may be reduced and/or prevented.

By way of summation and review, when heat generated by the driving circuit is not rapidly radiated to the outside but rather is accumulated, an erroneous operation may be caused, or the operation of the driving circuits may be stopped.

The embodiments provide a flat panel display (FPD) capable of effectively radiating heat generated by driving circuits.

For example, heat generated by the driving circuits and heat generated by input terminals, output terminals, and pads may be radiated to the outside and may be delivered to the display panel and the PCBs through the heat radiating units. Thus, it is possible to effectively reduce and/or prevent the driving circuits from being damaged due to accumulation of heat.

While the present invention has been described in connection with certain exemplary embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover

various modifications and equivalent arrangements included within the spirit and scope of the appended claims, and equivalents thereof.

What is claimed is:

1. A display device, comprising:

a display panel for displaying an image;

a film substrate electrically connected to the display panel, the film substrate including a driving circuit;

a printed circuit board (PCB) electrically connected to the film substrate, the printed circuit board providing a signal for displaying the image; and

a heat radiating unit attached to the driving circuit of the film substrate, wherein the heat radiating unit inlcudes thermally conductive material and is connected with at least one of the display panel and the PCB.

2. The display device as claimed in claim **1**, wherein the heat radiating unit includes:

a first contacting unit attached to the driving circuit of the film substrate, and

at least one second contacting unit that protrudes from an edge of the first contacting unit to an outside of the heat radiating unit, the second contacting unit contacting at least one of the display panel and the PCB.

3. The display device as claimed in claim **1**, wherein the heat radiating unit has a thin film shape.

4. The display device as claimed in claim **3**, wherein the thermally conductive material is formed of at least one of Al, Cu, W or alloys thereof.

5. The display device as claimed in claim **1**, wherein the heat radiating unit is attached to the driving circuit of the film substrate by an adhesive including a heat radiating paste.

6. The display device as claimed in claim **1**, wherein the heat radiating unit includes protrusions on at least one surface thereof.

7. The display device as claimed in claim **1**, wherein the display panel and the PCB each include metal pads, the heat radiating unit contacting the metal pads of at least one of the display panel and the PCB.

8. The display device as claimed in claim **1**, wherein the heat radiating unit contacts and is in thermal cooperation with the display panel and the PCB.

9. A display device, comprising:

a display panel;

a printed circuit board (PCB);

a film substrate provided between the display panel and the PCB; and

a heat radiating unit at least partly overlapping a film substrate and including thermally conductive material to radiate a heat from the film substrate.

10. The display device as claimed in claim **9**, wherein the film substrate comprises a driving circuit and the heat radiating unit radiates the heat from the driving circuit.

11. The display device as claimed in claim **10**, wherein the driving circuit comprises input and output terminals and the heat radiating unit contacts parts adjacent to the input and output terminals.

12. The display device as claimed in claim **10**, wherein the heat radiating unit comprises:

a first contacting unit attached to a surface of the film substrate; and

a second contacting unit that protrudes from an edge of the first contacting unit,

wherein the driving circuit overlaps the first contacting unit.

13. The display device as claimed in claim **12**, wherein the second contacting unit is provided in plural, the second contacting units contact at least one of the display panel and the PCB.

14. The display device as claimed in claim **12**, wherein the first contacting unit is separated from at least one of the display panel and the PCB.

15. The display device as claimed in claim **9**, wherein the thermally conductive material comprises at least one of Al, Cu, W, or alloys thereof.

16. The display device as claimed in claim **9**, wherein the heat radiating unit is attached to a surface of the film substrate by an adhesive including a heat radiating paste.

17. The display device as claimed in claim **9**, wherein the heat radiating unit includes protrusions on at least one surface thereof.

18. The display device as claimed in claim **9**, wherein the display panel and the PCB each include metal pads, the heat radiating unit contacting the metal pads of at least one of the display panel and the PCB.

19. The display device as claimed in claim **9**, wherein the heat radiating unit contacts and is in thermal cooperation with the display panel and the PCB.

20. A display device, comprising:

a display panel;

a film substrate including a driving circuit electrically connected to the display panel;

a printed circuit board (PCB) connected to the film substrate; and

a heat radiating unit connected to at least one of the display panel and the PCB,

wherein the heat radiating unit includes thermally conductive material to radiate a heat from the driving circuit.

* * * * *